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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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55	Space Biology Includes exobiology; planetary biology; and extraterrestrial life.	N.A.

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Typical Report Citation and Abstract

- ❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
- ❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 473)

SEPTEMBER 7, 1998

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LIFE SCIENCES (GENERAL)

19980203273 Florida Univ., Gainesville, FL USA

Journal of Quantum Chemistry, Quantum Biology Symposium No. 24 Final Report, 28 Jan. 1997 - 27 Jan 1998

Oehrn, Yngve, Editor, Florida Univ., USA; Sabin, John R., Editor, Florida Univ., USA; Zerner, Michael C., Editor, Florida Univ., USA; Lowdin, Per-Oloy, Editor, Florida Univ., USA; International Journal of Quantum Chemistry; Mar. 1997; ISSN 0020-7608; Volume 65, No. 6; 186p; In English; Application of Fundamental Theory to Problems of Biology and Pharmacology International, 1-7 Mar. 1997, Saint Augustine, FL, USA

Contract(s)/Grant(s): DAAG55-97-1-0020

Report No.(s): AD-A344264; ARO-36224.1-PH-CF; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The 37th Annual Sanibel Symposium, organized by the faculty, students, and staff of the Quantum Theory Project of the University of Florida, was held on March 1-7, 1997. The meeting was again held at the Ponce de Leon Conference Center in St. Augustine, Florida. The symposium followed the established format with plenary and poster sessions. This year, the schedule was shortened somewhat with a compact seven-day integrated program of quantum biology, quantum chemistry, and condensed matter physics. The topics of the sessions covered by these proceedings include Quantum Biology, Quantum and Classical Molecular Dynamics, Protein Structure and Folding, Monte Carlo Simulations, and Free Energy Calculations of Biological Molecules. The articles have been subjected to the ordinary refereeing procedures of the International journal of Quantum Chemistry. The articles presented in the sessions on quantum chemistry, condensed matter physics, and associated poster sessions are published in a separate issue of the International Journal of Quantum Chemistry.

DTIC

Molecular Biology; Quantum Chemistry; Conferences; Quantum Theory; Pharmacology

19980203719 Sandia National Labs., Albuquerque, NM USA

LDRD project: Semiconductor surface-emitting microcavity laser spectroscopy for analysis of biological cells and microstructures Final Report

Gourley, P. L., Sandia National Labs., USA; McDonald, A. E., Sandia National Labs., USA; Gourley, M. F., Washington Hospital Center, USA; Bellum, J., Coherent Technologies, Inc., USA; Aug. 1997; 30p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1988; DE97-009148; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This article discusses a new intracavity laser technique that uses living or fixed cells as an integral part of the laser. The cells are placed on a GaAs based semiconductor wafer comprising one half of a vertical cavity surface-emitting laser. After placement, the cells are covered with a dielectric mirror to close the laser cavity. When photo-pumped with an external laser, this hybrid laser emits coherent light images and spectra that depend sensitively on the cell size, shape, and dielectric properties. The light spectra can be used to identify different cell types and distinguish normal and abnormal cells. The laser can be used to study single cells in real time as a cell-biology lab-on-a-chip, or to study large populations of cells by scanning the pump laser at high speed. The laser is well-suited to be integrated with other micro-optical or micro-fluidic components to lead to micro-optical-mechanical systems for analysis of fluids, particulates, and biological cells.

DOE

Cells (Biology); Laser Spectroscopy; Laser Cavities; Real Time Operation; Semiconductor Lasers; Surface Emitting Lasers; Cytology; Gallium Arsenides

19980203828 Los Alamos National Lab., NM USA

Computer simulation of protein solvation, hydrophobic mapping, and the oxygen effect in radiation biology

Pratt, L. R., Los Alamos National Lab., USA; Garcia, A. E., Los Alamos National Lab., USA; Hummer, G., Los Alamos National Lab., USA; [1997]; 22p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2321; DE97-008596; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory-Directed Research and Development project at the Los Alamos National Laboratory. Hydrophobic effects are central to the structural stability of biomolecules, particularly proteins, in solution but are not understood at a molecular level. This project developed a new theoretical approach to calculation of hydrophobic effects. This information theory approach can be implemented with experimental, including computer simulation-experimental, information. The new theory is consistent with, builds upon, and subsumes previous integral equation and scaled particle statistical thermodynamic modes of hydrophobic effects. The new theory is sufficiently simple to permit application directly to complex biomolecules in solution and to permit further expansion to incorporate more subtle effects.

DOE

Biochemistry; Computerized Simulation; Proteins; Solvation; Oxygen; Molecular Biology

19980204708 Forest Service, Pacific Northwest Research Station, Portland, OR USA

Phytomass in Southeast Alaska

Mead, B. R., Forest Service, USA; May 1998; 62p; In English

Report No.(s): PB98-148919; FSRP-PNW-505; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Phytomass tables are presented for the southeast Alaska archipelago. Average phytomass for each sampled species of tree, shrub, grass, forb, lichen, and moss in 10 forest and 4 nonforest vegetation types is shown. These data provide a tool for estimating habitat carrying capacity for many wildlife species. They also may be used for estimating extent of the resources for traditional uses, such as berry production, and relative abundance of other plants that may be important to a subsistence lifestyle. Tree phytomass is reported for the entire aboveground tree, thereby allowing estimates of total fiber content.

NTIS

Biomass; Vegetation; Archipelagoes

19980206166 North Carolina Univ., Dept. of Physical Science, Pembroke, NC USA

Preliminary Work in Obtaining Site-Directed Mutants of Hen Egg White Lysozyme

Holmes, Leonard D., North Carolina Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Protein crystal growth studies are recognized as a critical endeavor in the field of molecular biotechnology. The scientific applications of this field include the understanding of how enzymes function and the accumulation of accurate information of atomic structures, a key factor in the process of rational drug design. NASA has committed substantial investment and resources to the field of protein crystal growth and has conducted many microgravity protein crystal growth experiments aboard shuttle flights. Crystals grown in space tend to be larger, denser and have a more perfect habit and geometry. These improved properties gained in the microgravity environment of space result largely from the reduction of solutal convection, and the elimination of sedimentation at the growing crystal surface. Shuttle experiments have yielded many large, high quality crystals that are suitable for high resolution X-ray diffraction analysis. Examples of biologically important macromolecules which have been successfully crystallized during shuttle missions include: lysozyme, isocitrate lyase, gamma-interferon, insulin, human serum albumin and canavalin. Numerous other examples are also available. In addition to obtaining high quality crystals, investigators are also interested in learning the mechanisms by which the growth events take place. Crystallization experiments indicate that for the enzyme HEWL, measured growth rates do not follow mathematical models for 2D nucleation and dislocation-led growth of tetragonal protein crystals. As has been suggested by the laboratory of Marc L. Pusey, a possible explanation for the disagreement between observation and data is that HEWL tetragonal crystals form by aggregated units of lysozyme in supersaturated solutions. Surface measurement data was shown to fit very well with a model using an octamer unit cell as the growth unit. According to this model, the aggregation pathway and subsequent crystal growth is described by: monomer ----- > dimer ----- > tetramer ----- > octamer ----- > higher order. It is believed that multimer aggregation of lysozyme occurs by interaction at specific binding sites on the surface of the protein crystals. If the presence of discrete binding sites and the aggregation hypothesis is true, then it follows that the alteration of the binding site(s) should have significant effect on the measurements obtained during growth experiments. Site-di-

rected mutagenesis allows the specific alteration of proteins by replacement, deletion or addition of specific amino acid residues. This report outlines the approach for this strategy and the progress made thus far toward that end.

Author

Protein Crystal Growth; Lysozyme; Gravitational Effects; Biotechnology; Enzymes; Space Processing; Protein Synthesis; Mutagens; Deoxyribonucleic Acid; Macromolecules

19980206204 Alabama Univ., Dept. of Biological Sciences, Huntsville, AL USA

Receptor Expression in Rat Skeletal Muscle Cell Cultures

Young, Ronald B., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

One of the most persistent problems with long-term space flight is atrophy of skeletal muscles. Skeletal muscle is unique as a tissue in the body in that its ability to undergo atrophy or hypertrophy is controlled exclusively by cues from the extracellular environment. The mechanism of communication between muscle cells and their environment is through a group of membrane-bound and soluble receptors, each of which carries out unique, but often interrelated, functions. The primary receptors include acetyl choline receptors, beta-adrenergic receptors, glucocorticoid receptors, insulin receptors, growth hormone (i.e., somatotropin) receptors, insulin-like growth factor receptors, and steroid receptors. This project has been initiated to develop an integrated approach toward muscle atrophy and hypertrophy that takes into account information on the populations of the entire group of receptors (and their respective hormone concentrations), and it is hypothesized that this information can form the basis for a predictive computer model for muscle atrophy and hypertrophy. The conceptual basis for this project is illustrated in the figure below. The individual receptors are shown as membrane-bound, with the exception of the glucocorticoid receptor which is a soluble intracellular receptor. Each of these receptors has an extracellular signalling component (e.g., innervation, glucocorticoids, epinephrine, etc.), and following the interaction of the extracellular component with the receptor itself, an intracellular signal is generated. Each of these intracellular signals is unique in its own way; however, they are often interrelated.

Author

Atrophy; Gravitational Effects; Microgravity; Muscles; Receptors (Physiology)

52

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

19980203583 Civil Aeromedical Inst., Oklahoma City, OK USA

Aeromedical Aspects of Melatonin: An Overview Final Report

Sanders, D. C., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Hordinsky, Jerry R., Civil Aeromedical Inst., USA; Mar. 1998; 22p; In English

Contract(s)/Grant(s): AM-B-97-TOX-202

Report No.(s): DOT/FAA/AM-98/10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Melatonin, a pineal hormone present in the blood of humans and other species, has a distinct diurnal variation in its biosynthesis and, therefore, in its concentration. This variation has suggested the possibility of a regulatory function in day/night-dependent physiological processes, such as sleep, and has led scientists to explore the effects of administered melatonin on the modulation of circadian rhythms. For the self-treatment of sleep disorders and other benefits, melatonin usage has been extolled, to the extent that 20 million new consumers were added to the U.S. retail market in 1995. Its principal aeromedical application has been in the experimental treatment of jet lag effects. For aircraft passengers, melatonin administration at destination-bedtime appears to improve sleep quality and to decrease the time required to reestablish normal circadian rhythms. For international aircrews, who travel through multiple time zones without time to adapt to new environments, taking melatonin prior to arriving home may further impair already disturbed circadian rhythms. Its use to adjust to shiftwork changes by air traffic controllers, aircraft maintenance workers, and support personnel is even more controversial. Limited studies suggest that giving this hormone to shift workers should be done only under controlled conditions and that taking it at the wrong time may actually impair job performance. Because of its possible interaction with certain medications and the changes in its concentrations observed in some clinical conditions, the practitioner must exercise caution during the medical certification of airmen. The variations in the concentration of melatonin can be effectively determined by radioimmunoassay, high-performance liquid chromatography, and gas chromatography-mass spectroscopy analytical techniques. These techniques are capable of measuring the human daytime (10 pg/ml) and nighttime (30- 120 pg/ml) melatonin in plasma/serum. Melatonin measurements in victims of accidental deaths may allow forensic scientists and accident investigators to utilize the relationship between its concentration and the time of day when death occurred. The most

accurate estimations of the time of death result from analysis of melatonin content of the whole pineal body, whereas less accurate estimates are obtained from serum and urine analyses-pineal levels of melatonin are unlikely to be altered by exogenous melatonin, but its blood and urine levels would change. Its high blood levels in a daytime crash victim would suggest exogenous supplementation. The possible interfering effects of postmortem biochemical processes on melatonin concentrations in whole blood and in other tissues are not

Author

Biochemistry; Pharmacology; Toxicology; Jet Lag; Accident Investigation; Diurnal Variations

19980203927 Army Research Inst. of Environmental Medicine, Natick, MA USA

Joint Service Lightweight Integrated Suit Technology Program: Heat Strain Evaluation in an Environmental Chamber and in the Field

Levine, Leslie, Army Research Inst. of Environmental Medicine, USA; Johnson, Richard F., Army Research Inst. of Environmental Medicine, USA; Teal, Walter B., Jr., Army Research Inst. of Environmental Medicine, USA; Cadarette, Bruce S., Army Research Inst. of Environmental Medicine, USA; Merullo, Donna J., Army Research Inst. of Environmental Medicine, USA; Mar. 1998; 209p; In English; Prepared in collaboration with Geo-Centers, Inc., Newton, MA.

Report No.(s): AD-A343851; USARIEM-TR-70-25; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The Joint Service Lightweight Integrated Suit Technology (JSLIST) Program, defined in a 1993 Memorandum of Agreement signed by representatives of the U.S. Marines, Army, Navy, and Air Force, is responsible for overseeing development, production, and deployment of the next generation of chemical/biological protective suits. This report is of two human studies conducted to: (1) address the services requirement for new garments that impose less heat stress than current protective garments, and (2) provide data for the Health Hazard Assessment. The suits tested included overgarment, undergarment and duty uniform concepts. The field study was conducted at Yuma Proving Ground, AZ in the summer of 1995, and a controlled environmental chamber study was conducted in the summer of 1996 at the USA Army Research Institute of Environmental Medicine and the USA Navy Clothing and Textile Research Facility, Natick, MA. Physiological measures were made of rectal temperature, skin temperature, heart rate, sweating rate, and test time; while questionnaires evaluated subjective symptoms of heat illness. The results of the field and chamber studies indicate that the Army's Battledress Overgarment imposes the most heat strain, the Marine Saratoga and Navy Chemical Protective Overgarment impose the least, and the JSLIST prototype garments imposed heat strain that ranged between the worst and best controls.

DTIC

Body Temperature; Signs and Symptoms; Protective Clothing; Heat Tolerance; Test Chambers

19980203938 Los Alamos National Lab., NM USA

Distributed telemedicine for the National Information Infrastructure

Forslund, D. W., Los Alamos National Lab., USA; Lee, Seong H., Los Alamos National Lab., USA; Reverbel, F. C., Los Alamos National Lab., USA; [1997]; 6p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2047; DE97-008716; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

TeleMed is an advanced system that provides a distributed multimedia electronic medical record available over a wide area network. It uses object-based computing, distributed data repositories, advanced graphical user interfaces, and visualization tools along with innovative concept extraction of image information for storing and accessing medical records developed in a separate project from 1994-5. In 1996, we began the transition to Java, extended the infrastructure, and worked to begin deploying TeleMed-like technologies throughout the nation. Other applications are mentioned.

DOE

Telemedicine; Computer Networks; Information Systems; Graphical User Interface

19980205633 Veridian, Dayton, OH USA

Variability of Hearing Protector Attenuation Measurement Data: A View of Interlaboratory Studies Interim Report, Jan. 1997 - Jan 1998

Nixon, Charles W., Veridian, USA; Jan. 1998; 48p; In English

Contract(s)/Grant(s): F41624-95-C-6014; AF Proj. 7184

Report No.(s): AD-A343956; AFRL-HE-WP-SR-1998-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of national and international measurement standards is to provide consensus procedures that produce reliable qualitative and quantitative data. A standard measurement procedure is expected to produce similar results when implemented by dif-

ferent users. The effectiveness of hearing protection devices in noisy environments is determined using procedures that comply with hearing protector attenuation measurement standards. However, the values collected under these specified conditions do not show the expected levels of repeatability. Results in one laboratory are usually not repeat in others. The inability to achieve the expected similarity of results is attributed to the numerous sources of variability in the measurement processes and facilities. Some sources of variability cannot be eliminated; others may be minimized with knowledge about the sources and proper actions initiated to counteract them. Variability is so extensive in these data that utilization of the results can increase the probability of incorrect conclusions. Variability among interlaboratory comparison studies with each using the same measurement standard are reviewed and discussed. This discussion is intended primarily, but not exclusively, for those who may not be fully informed about the measurement of hearing protector attenuation.

DTIC

Probability Theory; Variability; Analogies; Hearing

19980205634 Veridian, Dayton, OH USA

Articulated Total Body Model, Version 5, User's Manual

Cheng, Huaining, Veridian, USA; Rizer, Annette L., Veridian, USA; Obergefell, Louise A., Veridian, USA; Feb. 1998; 107p; In English

Contract(s)/Grant(s): F-41624-95-C-60114; AF Proj. 7184

Report No.(s): AD-A343957; AFRL-HE-WP-TR-1998-0015; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Articulated Total Body (ATB) Model is used by the Air Force Research Laboratory (AFRL) and other organizations, companies and educational institutions for predicting gross human body response in various dynamic environments, especially automobile crashes and aircraft ejection with wind blast exposure. The ATB-V Model introduces three new simulation tools: (1) water force simulation, (2) joint actuator simulation, and (3) deformable segments, along with several minor changes. This User's Guide accompanies the release of the ATB-V version. It contains comprehensive information on the ATB model and its input structure. It is restructured completely from the previous version's User Guide with extensive modifications. Section 1 provides guidelines on how to install and the ATB program. Section 2 gives a general description of the ATB model and its structure. An overview of the ATB input data and output files is provided in Section 3. The appendices contain example input and output files from the model.

DTIC

Computerized Simulation; Predictions; Deformation; Education; Actuators

19980205843 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Thermal Environment of Litter Positions and Human Responses Onboard Hercules C-130 Aircraft

Walsh, Margaret M., Air Force Inst. of Tech., USA; May 15, 1998; 95p; In English

Report No.(s): AD-A344548; AFIT-98-011; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This non-experimental, descriptive correlational research study examined the thermal environment of lifter positions and human responses onboard the Hercules C-130 aircraft. The C-130 aircraft is a cargo aircraft that can be configured to transport patients. Thermal stress is one of eight stresses of flight patients experience in the airborne environment. The study measured ambient air temperature, air flow, perception of thermal environment, perception of thermal comfort, tympanic temperature and skin temperature. Measurements were obtained preflight, post flight and every fifteen minutes inflight.

DTIC

Thermal Stresses; Thermal Environments; Responses; Thermal Comfort

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

19980203353 Minnesota Univ., Dept. of Psychology, Minneapolis, MN USA

Cognitive Modeling and Task Analysis: Basic Processes and Individual Differences Final Report, 1 Apr. - 15 Dec. 1997

Ackerman, Phillip L., Minnesota Univ., USA; Dec. 1997; 7p; In English

Contract(s)/Grant(s): F49620-97-1-0209; AF Proj. 2313

Report No.(s): AD-A339222; AFRL-SR-BL-TR-98-0245; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The multi-pronged research program is aimed at developing and empirically evaluating an integrated component approach that determines how critical task characteristics and human operator characteristics interact to produce degraded performance

under high workload conditions. The approach involves four major facets: (1) a synthetic task platform modeled on the U.S.A.F. Airborne Warning and Control Systems (AWACS) Weapons Director tasks; (2) a basic processes model of human information processing dimensions; (3) a model of individual differences characteristics; and (4) a military relevant simulation for testing and validation of the integrated process individual differences model.

DTIC

AWACS Aircraft; Warning Systems; Workloads (Psychophysiology)

19980206093 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Color Constancy: Color Recovery from Biased Illumination

Hwang, Po-Wie, National Tsing Hua Univ., Taiwan, Province of China; Hsu, Wen-Hsing, National Tsing Hua Univ., Taiwan, Province of China; Chen, Yung-Sheng, Yuan-Ze Inst. of Tech., Taiwan, Province of China; Cheng, Fang-Hsuan, Chung-Hua Polytechnic Inst., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 177-187; In English

Contract(s)/Grant(s): NSC81-0408-E007-530; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In color vision, it is of great importance to steadily extract color descriptors under various illuminative conditions. This is called color constancy. In general, the reflected light of an object is dependent on two components which are the illumination of the environment and the surface reflectance of the object. If we don't have enough information about the scene, we could not correctly say the color that we see is real or biased by the ambient light. Thus, all we can do is to feel it in global view. To estimate the surface reflectance even when the spectral distribution of the ambient light is unknown, an algorithm consisting of a finite-dimensional model, a homomorphic model, a statistical model, and a recovery model, is proposed. Some experiments conducted under different illuminative conditions confirm that the proposed algorithm is feasible.

Author

Color; Spectral Reflectance; Mathematical Models; Image Reconstruction; Light Transmission; Statistical Distributions

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19980203656 Mystech Associates, Inc., Falls Church, VA USA

Representation of Non Visual Stimuli as a Precursor to Mannequin Stimulation over the Internet Final Report, 23 Sep. 1997 - 30 Apr. 1998

Lyell, M. J., Mystech Associates, Inc., USA; Apr. 30, 1998; 252p; In English

Contract(s)/Grant(s): M67004-97-C-0047

Report No.(s): AD-A343396; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Report developed under SBIR contract. This effort resulted in a "Human Response to Stimuli" Federation Object Model (FOM). During this effort, an investigation into the representation of stimuli vis-a-vis the human recipient was performed. A Stimuli simulation object model and a Physiological simulation object model were developed prior to the construction of the FOM. As the present effort did not originate with legacy simulations, the first issue was to address the conceptual model of the mission space. In the development of the Stimuli SOM, the questions of scalability, relevance of stimuli, and characterization of stimuli were addressed. The effort resulted in the creation of a set of informational attributes and the concept of simple versus complex stimuli. Both "local" and "global" stimuli are considered. In the representation of the human body, physiological functioning guided the development of the Physiological SOM. Object oriented techniques were heavily utilized in populating this SOM. The question of extensibility, which has ramifications for distance education, is discussed. Different emphasis on intended utilization of the Federation resulted in two divergent FOM structures. Scenarios relevant to this Federation are presented in detail.

DTIC

Visual Perception; Human Reactions; Human Body; Visual Stimuli; Stimulation; Psychological Factors

19980206160 Texas A&M Univ., Bioengineering Program, College Station, TX USA

Evaluation of an Anthropometric Human Body Model for Simulated EVA Task Assessment

Etter, Brad, Texas A&M Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

One of the more mission-critical tasks performed in space is extravehicular activity (EVA) which requires the astronaut to be external to the station or spacecraft, and subsequently at risk from the many threats posed by space. These threats include, but are not limited to: no significant atmosphere, harmful electromagnetic radiation, micrometeoroids, and space debris. To protect the astronaut from this environment, a special EVA suit is worn which is designed to maintain a sustainable atmosphere (at 1/3 atmosphere) and provide protection against the hazards of space. While the EVA suit serves these functions well, it does impose limitations on the astronaut as a consequence of the safety it provides. Since the astronaut is in a virtual vacuum, any atmospheric pressure inside the suit serves to pressurize the suit and restricts mobility of flexible joints (such as fabric). Although some of the EVA suit joints are fixed, rotary-style joints, most of the mobility is achieved by the simple flexibility of the fabric. There are multiple layers of fabric, each of which serves a special purpose in the safety of the astronaut. These multiple layers add to the restriction of motion the astronaut experiences in the space environment. Ground-based testing is implemented to evaluate the capability of EVA-suited astronauts to perform the various tasks in space. In addition to the restriction of motion imposed by the EVA suit, most EVA activity is performed in a micro-gravity (weight less) environment. To simulate weightlessness EVA-suited testing is performed in a neutral buoyancy simulator (NBS). The NBS is composed of a large container of water (pool) in which a weightless environment can be simulated. A subject is normally buoyant in the pressurized suit; however he/she can be made neutrally buoyant with the addition of weights. In addition, most objects the astronaut must interface with in the NBS sink in water and flotation must be added to render them "weightless". The implementation of NBS testing has proven to be invaluable in the assessment of EVA activities performed with the Orbiter and is considered to be a key step in the construction of the International Space Station (ISS). While the NBS testing is extremely valuable, it does require considerable overhead to maintain and operate. It has been estimated that the cost of utilizing the facility is approximately \$10,000 per day. Therefore it is important to maximize the utility of NBS testing for optimal results. One important aspect to consider in any human/worksites interface is the considerable wealth of anthropometric and ergonomic data available. A subset of this information specific to EVA activity is available in NASA standard 3000. The difficulty in implementing this data is that most of the anthropometric information is represented in a two-dimensional format. This poses some limitations in complete evaluation of the astronaut's capabilities in a three-dimensional environment. Advances in computer hardware and software have provided for three-dimensional design and implementation of hardware with the advance of computer aided design (CAD) software. There are a number of CAD products available and most companies and agencies have adopted CAD as a fundamental aspect of the design process. Another factor which supports the use of CAD is the implementation of computer aided manufacturing (CAM) software and hardware which provides for rapid prototyping and decreases the time to product in the design process. It is probable that most hardware to be accessed by astronauts in EVA or IVA (intravehicular activity) has been designed by a CAD system, and is therefore represented in three-dimensional space for evaluation. Because of the implementation of CAD systems and the movement towards early prototyping, a need has arisen in industry and government for tools which facilitate the evaluation of ergonomic consideration in a three-dimensional environment where the hardware has been designed by the CAD tools. One such product is Jack which was developed by the University of Pennsylvania with funding from several government agencies, including NASA. While the primary purpose of Jack is to model human figures in a ground-based (gravity) environment, it can be utilized to evaluate EVA-suited activities as well. The effects of simulated gravity must be turned off by turning off "behaviors". Although Jack provides human figures for manipulation, the primary instrument to be evaluated for EVA mobility is the work envelope provided by the EVA suit. An EVA Jack suit model has been developed by NASA-JSC and was utilized in this study. This suit model provided a more restrictive motion environment as expected for an EVA suited subject. As part of this study, the anthropometric dimensions for a 50th percentile male were compared with basic anthropometric data and were found to be representative for the population group expected in the NASA flight program. The joints for the suit were created in a manner which provided consistent performance with EVA reach envelopes published in NASA standard #3000.

Derived from text

Anthropometry; Space Suits; Extravehicular Activity; Human Body; Human Factors Engineering; Models; Joints (Junctions); Computerized Simulation; Neutral Buoyancy Simulation

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